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A novel laparoscopic transcystic approach using an ultrathin choledochoscope and holmium laser lithotripsy in the management of cholecystocholedocholithiasis: An appraisal of their safety and efficacy

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ABSTRACT

Background: Although laparoscopic transcystic common bile duct exploration (LTCBDE) is the preferred approach for CBD stone clearance, the success rate can vary between 55% and 85%. This study evaluated if ultrathin choledochoscope and holmium laser lithotripsy could improve the success rate of LTCBDE.
Methods: Records of 126 patients (average age, 46.1 ± 13.8 years) with cholecystocholedocholithiasis treated with laparoscopic cholecystectomy (LC) and LTCBDE were retrospectively reviewed.
Results: LC+LTCBDE was performed successfully in 118 of 126 patients, with a surgical success rate of 93.7%. An ultrathin choledochoscope was used in 75 (63.5%) patients, and holmium lithotripsy was performed in 38 (32.2%) patients. The stone clearance rate was 99.2% (117/118). No significant complications occurred. One hundred (84.7%) patients had excellent and 13 (11%) had good outcomes for an overall success rate (excellent plus good) of 95.7%.
Conclusion: Ultrathin choledochoscope and holmium laser lithotripsy can improve the surgical outcomes of LC+LTCBDE with minimal complications.

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1. Background

Laparoscopic cholecystectomy (LC) has become the treatment of choice in the management of cholecystolithiasis.[1] In regards to the surgical treatment of common bile duct (CBD) stones, recent studies have shown that both the single-stage approach of LC with laparoscopic CBD exploration and the two-stage management using endoscopic retrograde cholangiopancreatography (ERCP) with endoscopic sphincterotomy (EST) followed by LC were equally effective in the clearance of CBD stones.[1,2] Compared with the two-stage approach, LC with laparoscopic CBD exploration was associated with a reduced risk of stone recurrence[2] and cholangitis[3] and thus gradually became the preferred approach for CBD stone clearance.[4]

Laparoscopic CBD exploration can be performed through a choledochotomy incision or through a transcystic approach. Although the choledochotomy approach provides a better view and unrestricted access of the bile duct,[5] the postoperative biliary complications are significantly greater than in the transcystic approach.[6] Laparoscopic choledochotomy is not suitable for patients with a thin CBD due to a high risk of bile leakage after primary duct closure.[7] In addition, in patients with a narrow CBD, laparoscopic choledocholithotomy carries a high risk of postoperative CBD stricture.[8]

Because an incision in the CBD wall is unnecessary using the transcystic approach, this approach has gradually gained wide applicability.[9] However, due to the diameter of the cystic duct and the size of the CBD stones, the surgical success rate of laparoscopic transcystic CBD exploration (LTCBDE) varies between 55% and 85%.[10] Since 2010, our surgical team has routinely used an ultrathin choledochoscope and a holmium laser lithotripsy system to perform the LTCBDE. Because the optimal laparoscopic management of concomitant gallstones and CBD stones[11] remains unclear,

List of abbreviations: CBD, common bile duct; LTCBDE, laparoscopic transcystic CBD exploration; LC, laparoscopic cholecystectomy; LC, Laparoscopic cholecystectomy; ERCP, endoscopic retrograde cholangiopancreatography; EST, endoscopic sphincterotomy.

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this study sought to highlight the importance of the ultrathin choledochoscope and the holmium laser lithotripsy system in improving the surgical success rate in the treatment of concomitant cholecystolithiasis and choledocholithiasis. Because the major focus of this study was to share surgical experiences, no comparison group of patients who underwent another surgical technique was included.

2. Patients and methods

This study was approved by the Institutional Review Board of our hospital, and because of the retrospective nature of the study, the requirement of informed consent was waived.

The medical records and surgical reports of patients with cholecystolithiasis complicated by secondary CBD stones treated at our hospital between January 2010 and December 2014 were reviewed for this study. The diagnosis of cholecystolithiasis was made by the abdominal ultrasonography, magnetic resonance cholangiopancreatography, and computed tomography. Clinical symptoms, the results of serological tests and results from imaging examinations were used for the diagnosis of CBD stones. All patients provided informed consent for the surgical procedures performed.

None of the patients had a contraindication for laparoscopic surgery. Exclusion criteria were: 1) primary bile duct stones; 2) acute cholecystitis; 3) severe obstructive jaundice; 4) hepatolithiasis; 5) cystic dilation of the bile duct complicated with CBD stones; 6) abnormal function of duodenal papilla; and 7) recurrent CBD stones due to endoscopic retrograde cholangiopancreatography and endoscopic sphincterotomy. There were no limitations with regards to the diameter of the CBD, the diameter of the cystic duct, or the size or number of CBD stones.

Laparoscopes used were those considered commonly available. The choledochoscopes used were Olympus CB30 and XP20 with outer diameters of 2.7 mm, and 4.9 mm, respectively. A choledochoscope with a diameter of <3 mm was considered ultrathin in this study. The holmium laser lithotripsy used in this study was produced by the Lumenis Company (Israel) with maximum output power of 100 W, and equipped with light-guide fibers with diameters of 0.36 mm and 0.55 mm.

All patients received endotracheal general anesthesia. The surgical procedures were performed by an experienced surgical team. The 4-port technique was used. Three 10–12 mm ports were inserted below the xiphoid, at the mdclavicular line along the right subcostal margin (i.e., the working channel of the choledochoscope), and below the umbilicus (i.e., the laparoscopic camera port). A 5 mm port was placed in the anterior axillary line along the costal margin. Fig. 1 shows the laparoscopic port placement.

Initial dissection of the cystic artery and cystic duct was performed after anatomic separation of Calot's triangle. The cystic artery was ligated and the cystic duct, as well as the junction between cystic duct and CBD, were fully dissected. A clip was placed on the cystic duct close to the gallbladder ampulla. The cystic duct was cut at a distance of 3 mm–5 mm from the CBD. Selection of the appropriately sized choledochoscope was made based on the diameter of the cystic duct, followed by the CBD exploration. A 4.9 mm diameter scope was first used followed by a 2.7 mm scope. In patients with a narrow cystic duct, a 2.7 mm diameter scope was used (Fig. 2).

A stone basket was used to extract the stones (Fig. 3) if the diameters of the stones were smaller than the diameter of the cystic duct. If the diameters of the stones were larger than the diameter of the cystic duct, the holmium laser lithotripsy system was used for stone fragmentation via the working channel of the choledochoscope (Fig. 4), followed by stone extraction using a basket. The choledochoscope was removed if there were no residual stones in the intrahepatic or extrahepatic bile ducts. The cystic duct proximal to the CBD was clipped. The cystic duct was then cut off and retrograde cholecystectomy was performed. The skin at the puncture points and incision sites was sutured after removing the gallbladder and the stones.

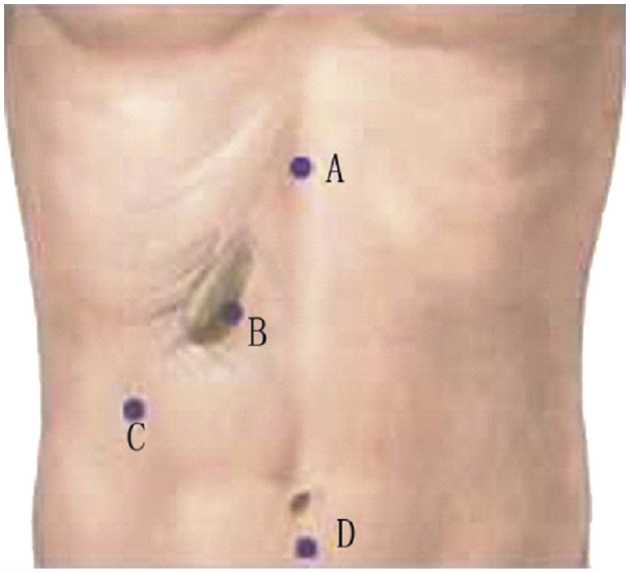

Fig. 1. Diagram showing the abdominal puncture point.

The variables used for the current analysis included demographic information, preoperative serological data, operative time, length of hospital stay, and short-term and long-term complications as well as surgical outcomes. Postoperative biliary function was assessed as previously described,[12] and surgical outcomes were categorized as excellent, good, fair, and poor, representing the status of biliary function and Clavien-Dindo classification which represented the status of biliary tract function.[13] Follow-up took place at 1 month, 3 months, and 6 months and from then on every 6 months. The purpose of the follow-up examination was early detection of postoperative complications and the evaluation of postoperative biliary function. The follow-up examination included abdominal ultrasonography, computed tomography, magnetic resonance imaging, and blood biochemistry tests.

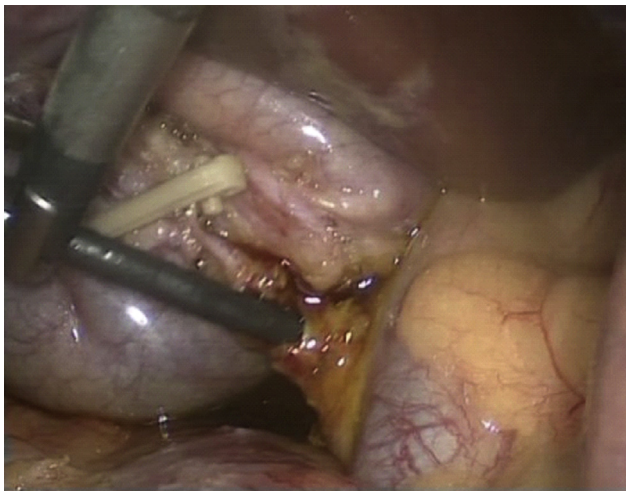

Fig. 2. Transcyctic insertion of a superfine choledochoscopy during surgery.

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